Message from the Dean

One of our goals at the Hajim School is TO BROADEN THE OPPORTUNITIES FOR A WIDE RANGE OF STUDENTS to participate in engineering and computer science.

As you will read in this issue of Full Spectrum, for example, the Department of Computer Science has recently enjoyed remarkable success in increasing its enrollment of female students—long underrepresented in the field—thanks to the department’s participation in the BRAID initiative and thanks to our University’s unique cluster system.

Clusters enable students from other disciplines to dive into an area that interests them with a sampling of courses. For female students from the pure sciences, social sciences, and humanities, this may be their first experience with computer science. They discover the power of coding; they realize computer science is more than creating video games; and they often decide to stick with it as a minor or second major.

Interestingly, we were not seeing the same success with the clusters offered by our other departments—mainly because students were put off by the math and physics required just to start taking the engineering courses.

So we’ve revisited those clusters, easing off on the hard-core math and physics components and stressing hands-on projects that show what engineering is all about. The Department of Electrical and Computer Engineering, for example, will now offer these new clusters: Musical Sound, Electronics and Programming for Music, and Sonic Technology.

We’re expanding our reach in another exciting way: This summer we will participate in two new NSF-sponsored programs offering research experiences for undergraduates (REUs). Underrepresented college students from elsewhere will come to Rochester to work with Hajim School and other University faculty and graduate students on multidisciplinary projects that showcase the remarkable breadth of resources here.

The “Advancing Human Health: From Nano to Network” REU, for example, will offer projects including biomaterials, medical optics for breast cancer, biomedical tissue engineering with ultrasound, dental biomechanics, biosensors, and robots for rehabilitation. The “Computational Methods for Understanding Music, Media, and Minds” REU will combine our University’s strengths in machine learning, audio engineering, music theory, and cognitive science to show what computing can tell us about the history of popular music, for example, or to help us salvage ancient musical scores.

Hopefully, some of these students will decide to return here for graduate school. In any event, we will benefit from their interactions with our faculty as well as their interactions with our own undergraduate students participating in summer research through the Xerox Engineering Research Fellows program and the McNair Post-Baccalaurate Achievement Program.

And if REUs and more-accessible clusters inspire more female and underrepresented minority students to pursue computer science and engineering—and if that helps those fields become more inclusive, representative professions—we’ll all stand to gain.

Meliora, Wendi B. Heinzelman, Dean

BRAVO!

CHIPS RECOGNIZE STAFF MEMBERS WHO GO ABOVE AND BEYOND

Michelle Kiso did more than organize a three-day event for prospective students last February. The graduate coordinator for the Department of Computer Science even got up at four o’clock on a Sunday morning to take two of the students to the airport because the Hilton Gardens Hotel shuttle wasn’t available.

Talk about above and beyond the call of duty! Her actions showed how important these candidates are to computer science and the Hajim School,” wrote Eileen Pulvara, the department’s administrator. Kiso’s good deed earned her a Hajim School Bravo chip, thanks to Pulvara’s nomination.

Launched in 2011 by former dean Rob Clark, the Bravo chip program “recognizes exemplary work” done by Hajim School and other University staff members in support of the school. It relies on nominations from fellow staff members, faculty members, department chairs, and administrators.

Recipients receive a letter of commendation and a distinctive blue and white Hajim School poker chip redeemable for a gift valued at $25 from the University IT Computer Store or a meal on campus at the Melissa Douglas, and Danforth dining centers. Some recipients hold on to them as valued mementos.

As of December 2016, 400 Bravo chips had been awarded to 211 individuals, of whom 71 (including Kiso and Pulvara) have received multiple awards. “Our staff really are fantastic,” says new dean Wendi Heinzelman, who is eager to keep the program going. “They go above and beyond on so much that they do, so this is a nice way to recognize them.”

While the reward is small in dollar value, says Jason Sabel, assistant chair of electrical and computer engineering, he believes it has a long-term benefit by improving employee morale.

“Whenever I nominate someone for the Bravo chip it generally lets their supervisors know that I gave this to them, and why, in case they are not aware,” says Sabel, who has received multiple Bravo chips himself. “We often hear what we did wrong and what needs to be improved, and it is good to hear ‘good job’ or ‘thank you’ every now and again, and this goes a long way. Sometimes their ideas or their help can save time and money for the University. This program is simple to use and allows us to immediately acknowledge that person.”

The program is also a good barometer of the cooperation that occurs across multiple departments, both within the Hajim School and across the University.

Last year, for example, the Hajim School undergraduate coordinator, as a group, nominated colleagues in the Office of the Registrar for promptly handling requests to change rooms, raise enrollment caps on courses, and add new sections to help accommodate the school’s increased enrollments.

When the graduate coordinator that Kiso replaced in computer science was not able to stay on and train her, Kiso turned to Michele Foster, her counterpart in electrical and computer engineering, at her “go to” person. “The help she [Foster] has provided to me, even though it was not her responsibility to, is a demonstration of her dedication to supporting student success for all students in the Hajim School,” Kiso wrote in nominating Foster for one of the many Bravo chips she has earned.

Similarly, Donna Porcelli, graduate program coordinator in biomedical engineering and another multiple Bravo chip recipient, became the “go to” person when a graduate co-ordinator went on disability in another department. Porcelli answered “many, many questions... happily and with a great deal of patience,” her Bravo citation noted. “Donna always answers her phone, and you can hear her smile.”

BRAVO, INDEED.
When Isabelle Schmit walked into the Department of Computer Science five years ago for freshman orientation, she looked around the room and counted only five women among 60 students.

Not anymore.

The number of female students who enroll in the department and graduate with degrees has increased dramatically in the last five years: “The increased visibility of students in the department has made a huge difference,” says Schmit ’16, who is pursuing a master’s degree at the University’s Goergen Institute for Data Science. In 2010 the department’s graduating class of 20 students included only one woman. This year, the expected graduating class of 119 students will be 34 percent female—double the national average.

This, despite a recent University of Washington study showing that computer science nationwide continues to be a male-dominated culture where many women feel they do not belong. Two factors have helped change that at Rochester.

Clusters provide a portal

The need for computing skills now permeates virtually every academic field, including the humanities and social sciences. The University’s unique open enrollment includes a cluster system that enables students to sample computer science courses, many for the first time, and then decide to continue with a minor or double major. “We may start with 25 percent female enrollment in our freshman class but gain more women who add or switch into computer science during their sophomore and junior years,” says Marty Guenther, the department’s undergraduate coordinator.

Seventy-six percent of the women graduating in the department’s class of 2016 were double majors, most of them also majoring in financial economics, digital media studies, linguistics, studio art, or mathematics. Participation by the department included stepping up its recruitment of females and underrepresented minorities, creating more accessible courses for its clusters and majors, doing outreach to K–12 students, and building community among its female and underrepresented minority students. BRAID also pays for female students to attend the annual three-day Grace Hopper Celebration of Women in Computing, the world’s largest conference of women technologists. Students attend seminars on networking and workplace skills, hear female role models talk about their work, talk to alumni who took the same classes from the same professors and are now succeeding, and connect with companies. Many of the students return with internship or job offers or a promising schedule of interviews. “The BRAID initiative has really been a game changer,” says Michael Scott, a professor of computer science who could afford to send only a handful of students to Grace Hopper during his 1996–99 tenure as department chair. Last fall, 26 students from computer science and data science attended the Hopper conference.

Schmit’s experience shows how important that can be. When she first attended Hopper as a senior in 2015, she was no longer convinced that web development—around which she had built her undergraduate program—was a career she wanted to pursue.

At the Hopper conference that year she heard successful women in top positions talk about using data science in their work. It was a turning point for Schmit. She had enjoyed artificial intelligence in class, but did not realize how integral the field was in data science. “Because it was a relatively new field, I never thought I could find a job in it!” After Hopper she knew otherwise and changed her career path accordingly.

When she attended Grace Hopper last fall, “it was so much nicer to be able to talk to companies and show them what I am passionate about,” Schmit says, “to see them being receptive to that and actually wanting me to work for them.” Schmit also took a lead role in organizing the other students who attended, which included holding preconference sessions on résumé writing and interview skills.

The Grace Hopper conferences help build a sense of community among the female students who attend, which in turn has been a catalyst for the Computer Science Undergraduate Council (CSUG). WC has about 100 members. Its meetings and events further the sense of community among female students.

For example, at “coding parties,” students work on problems together and share ideas: “It’s nice to have a place where lots of girls are doing the same thing,” says WC president Euakarn (Som) Liengtiraphan ’17.

The group also has worked with CSUG and Dwarkadas to sponsor department “town hall” meetings to address concerns among female students about professor approachability, TA sensitivity, and having study spaces where women feel comfortable.

Continued on page 7
Why apply for an Internship?

Just ask Hajim School seniors Nicholas Kochan and Laura Bochenek. As a result of their internship experiences last summer:

- Kochan, an optics major who spent the summer at MIT’s Lincoln Laboratory, has his eyes firmly set on graduate school. He now has a better appreciation for how the divide between theory and practice blurs as engineering projects evolve from basic research to application.
- Bochenek, a computer science major who worked for Etsy, learned she really can “cut it” as a software engineer. In fact, she has received a job offer from Etsy to be just that when she graduates.

Dean Wendi Heinzelman says internships are one of three key experiences that undergraduates should have in addition to their classroom (hands-on research and global experience being the other two).

A summer or semester spent in an engineering workplace helps students “see the material you learn in class in an entirely new way,” Heinzelman says. “You’ll see the application of that knowledge to something that has to go into a product, within even more constraints than in a classroom.”

Internships help engineering students narrow down the myriad options available to them after they graduate. Even a negative experience can be beneficial, says Laura Bochenek. “Sometimes we talked about work-related topics but other times about being in tech and what it means to have a job. This was really important, and I would definitely emphasize to anyone looking for an internship to go to a company that is going to develop you,” Bochenek says.

Kochan approached Lincoln Laboratory presenters at last fall’s meeting of the Industrial Associates—companies that partner with the Institute of Optics and provide students with networking opportunities. “It’s not the formal presentations that count; it’s learning about what the people are like,” Kochan says. “They were very energetic and passionate.”

Kochan worked at the lab in the Optical Engineering group on a telescope incorporating freeform optics. He helped test the surface qualities of the components and then align them. This was no easy task—especially for someone with no previous experience in the field—because freeform optics “break the degrees of symmetry that you have in normal imaging.” However, Kochan learned he could rely on other members of the team to help him. “Now, I find a field that’s interesting, I’ll have more confidence I can go into it and work with people toward a common goal,” he says.

He was pleasantly surprised by the supportive social environment at the Lincoln Lab. Dining out with new and departing colleagues was encouraged, along with weekly ice cream outings. “It was nice to see everyone was very serious about their work,” Kochan says, “but that was possible because people were balanced about it. They were not just go, go, go, all the time.”

“Most of what I learned I could not learn in class,” she says. For example, a big emphasis was placed on project management, setting out timelines for each stage of a project and being held to them. She appreciated the mentorship she received in weekly meetings with her supervisor and with her “intern buddy.”

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Women in Computer Science, continued from page 4

The University of Washington study identified “lack of pre-college experience” as a contributing factor to female underrepresentation in computer science. The department has increased its outreach to female high school students through University summer programs. Its female students are also helping address the problem by working with Rochester-area schools and local Girl Scouts to introduce computing to young women.

The events often include testimonials about the empowerment that comes with learning to code. “You don’t need a lot of experience ... anybody can do coding,” Mikaela Kunst ’17 told students at the Harlay School in Rochester last fall. “Why do I like computer science? It’s literally magic. I’m putting words on a page, and it’s doing these incredible things.”

Guenther, who joined the department in 1992, can remember “years in a row” when there were “no women at all in the graduating classes.” Now the increasing presence of women is manifested in many ways. For example, nearly half of the student workshop leaders for introductory classes are women, providing role models for the women in those classes. Similar percentages of women participate on Rochester computing teams that compete against other colleges. That raises eyebrows among students from other schools. And it sends a message. “I think we’re getting a reputation as a woman-friendly campus,” Guenther says.

Under Dwarkadas’s leadership, the computer science department “has been a wonderful partner in the BRAID project,” says Cal Ragan, program manager for academic initiatives at the Anita Borg Institute. “Along with the 14 other BRAID schools, Rochester is truly helping to define what diverse and inclusive computer science education looks like in the 21st century.”
Master’s Students
Find Programs to Match Their Needs

Rohit Prakash knew exactly what he wanted: a master’s degree program that could combine elements of physics, math, optics, and computational techniques to enable him to get a holistic understanding of image formation and imaging systems.

The challenge was finding one place that would give him access to experts in all those disciplines. After searching across Europe, he found his answer at the Institute of Optics in Rochester, New York.

“You have the Medical Center next door. You have physics, optics…it’s all in one place. In my perspective, this is a big factor,” says Prakash, who will complete his master of science degree requirements this summer.

Prakash’s experience illustrates why it hasn’t been hard for the Hajim School to sharply increase enrollment in its master’s programs. “A lot of what makes us different comes down to collaboration and customization of degree programs,” says Gristen Briscoe, director of graduate enrollment for Arts, Sciences & Engineering. “If students come in for optics but are also interested in working in brain and cognitive sciences or maybe at the Medical Center, they can do that. That’s a really big selling point when I talk to students.”

Electrical and computer engineering has traditionally hosted the largest master’s enrollments in the Hajim School. Recently, however, some of the biggest increases have been in optics, computer science, data science, and Technical Entrepreneurship and Management. Medical device design, offered through the Center for Medical Technology and Innovation, is gaining traction. New this year is an interdisciplinary master’s program in computational linguistics.

Master’s degree students in the Hajim School, by and large, want to spend one—or maybe two—years obtaining practical skills that will land them a job in industry. Many of the programs they enroll in offer multiple pathways or concentrations to do so.

Optics master’s students, for example, can choose a two-semester standard coursework track (three semesters with a summer residency), a three to four semester thesis track, or a four-semester master’s/co-op program. Computer science allows master’s students to focus on one area of computer science or cover the breadth of the field on a full- or part-time basis.

Many students pursuing master’s degrees at the Hajim School major as undergraduates in one discipline but want to enhance their résumés with complementary skills in another discipline before competing in the job market. That is especially true in the computer science and data science master’s programs.

“The don’t want to go back and get a second bachelor’s degree, and a master’s gives them a chance to refine their skill set in computer science,” says Michelle Kuss, graduate coordinator in the Department of Computer Science.

The data science program combines machine learning with math and statistics to allow students to analyze large data sets. Michelle Vogl, academic program manager for the Goergen Institute for Data Science, says many of the students are math majors or have backgrounds in the social sciences or business. “They’re looking for those machine learning courses and for the skills that a lot of job descriptions now require,” Vogl says.

Other students are getting a master’s degree to help them advance more quickly in the career they’ve already started or to switch careers altogether. Bella Wang, for example, studied economics in China, landed a job there with Morgan Stanley, and then decided her real passion was computer science. Rochester accommodated her. “Some of the computer science programs at other universities accept you only if you have a computer science background,” Wang says. Rochester not only allowed her to enter the program here but then let her switch her concentration from human-computer interaction to artificial intelligence.

“It’s been a very enriching experience for me,” she says. The program has allowed her to catch up on computer science basics, hone her presentation skills, and dive into data mining to forecast stock prices in the lab of Jiebo Luo, an associate professor of computer science.

For Amy Franz ’15, a master’s degree from the Institute of Optics helped her advance her career in exciting new directions after working at a small start-up company where new opportunities were limited. Her boss suggested she consider further education at the institute. “I had a great experience in the master’s lab course. The curriculum gives hands-on optics laboratory exposure in a variety of topics and ends with an open-ended project that mimics real-world experiment design,” Franz says. “It was a lot of fun.”

The institute’s Industrial Associates Program was an added perk. The program brings corporate partners in optics and photonics to the institute twice a year to share ideas and network with students. “I was hired at Edmund Optics thanks to Industrial Associates,” Franz says. “Besides giving me the platform to interact with companies, IJ members had confidence that I had the necessary background and education to be successful.” She’s now in the company’s Engineering Leadership Program.

The increase in master’s enrollment has benefited the Hajim School in several ways. “Master’s students help us achieve greater diversity; they help mentor undergraduates as TA’s (teaching assistants); they add to our alumni base,” says Briscoe.

But they also need a different set of skills than the PhD students. “They can’t be as theoretical as PhD students if they are going to successfully compete for a job,” Briscoe says. “They need access to internships, which increases the need to connect with companies. Fortunately, we’re at an enrollment where we can attract larger companies to campus to recruit.”

Briscoe has worked with the Gwen M. Greene Career and Internship Center to provide workshops on topics like writing résumés and cover letters. She also brings a photographer to campus each semester so master’s students can have free professional photos taken for their LinkedIn profiles.

Master’s students stay a shorter time than either undergraduates or PhD students. Dean Wendi Hinzelman, who previously served as dean of graduate studies for A&S, says it is important for the school to do all it can to help master’s students feel part of the Hajim community. “They are an important group, and we want to support them while they are here,” she says.

Even with the increase in master’s enrollment, the programs in the Hajim School remain more intimate than at larger universities. “We’re smaller than a lot of other computer science programs, less anonymous,” says Kuss. “I know all of our students, our faculty know all of our students. That’s really attractive to people.”

Pakash, who represents master’s students on the Institute of Optics graduate committee, says the institute has been receptive to the needs of its master’s students. “It’s a very active department, so when there are points to be addressed, they usually get addressed quite quickly.”
FACULTY AWARDS

Robert Boyd, professor of optics, was named a fellow of IEEE.

Sandhya Dwarkadas, the Albert ArnoldHopeman Professor of Engineering and chair of computer science, was named a fellow of IEEE.

Ehsan Hoque, assistant professor of computer science, received a World Technology Award from the World Technology Network.

Amy Lerner, associate professor of biomedical engineering, was a recipient of a University 2016 Guangzhou Award for Excellence in Undergraduate Teaching.

Kevin Parker, the William F. May Professor and dean of engineering, was named a fellow of the National Academy of Inventors.

The names behind the awards that define student excellence

At the Hajim School commencement each spring, the roll call of undergraduates who step forward to receive their diplomas is sprinkled with other names as well. Several of the awards these students receive from the school or their departments are named for alumni or former faculty members.

The awards are important to the Hajim School for several reasons. They celebrate and reward the achievements of students who seize the “full spectrum” of educational opportunities available to engineering students at Rochester.

They help reinforce the values that the Hajim School holds important. The Robert L. Wells Award, for example, is given to students who demonstrate competence in both engineering and the humanities. Anne Wells explains that early in their marriage, her husband bought the complete set of Great Books of the Western World, edited by Robert Maynard Hutchins. “Throughout his life he continued to read these books as well as histories and biographies,” she says. “He felt strongly that an engineer needed the balance of the humanities to be a competent engineer.”

Lisa Norwood, the school’s assistant dean for undergraduate studies, concurs. “Although engineers are problem solvers, as problems become larger and more complex, it’s important that our students are skilled in communicating with each other, their customers, and with other stakeholders in order to effectively solve these problems,” she says.

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The prizes also serve as an enduring testament to the engineering alumni and former faculty members who have served the Hajim School well through their gifts and accomplishments.

There are multiple opportunities to endow additional undergraduates and graduate awards and fellowships, and for loved ones or colleagues to do the same in honor of an engineering alumnus or former faculty member.

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ADVANCEMENT

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FAST FACTS

• The Hajim School’s undergraduate enrollment has more than doubled since 2008–09.

• Of current Hajim School undergraduates, 31 percent are female, 23 percent are international, and 11 percent are underrepresented minorities.

• Contributions to the Hajim School Annual Fund increased from $158,357 in 2009–10 to $669,000 in 2015–16.